First Metatarsophalangeal Arthrodesis: A Comparison of Operative Techniques

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Disclaimer

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Douglas E Lucas, DO

- My disclosure is in the Final AOFAS Mobile App.
- I have no potential conflicts with this presentation.
Introduction

- Hallux rigidus is a common condition treated by foot and ankle surgeons. Second only to hallux valgus in frequency\(^1\).
- 1st Metatarsophalangeal (MTP) joint arthrodesis is the gold standard for treatment of severe hallux rigidus, severe hallux valgus and others\(^2\).
- Two techniques for joint preparation are frequently reported; flat cut and “cup and cone reamer” techniques. These have never been directly compared.
- Dorsal plating of the arthrodesis site with early generation locked plates was found to have superior biomechanical stability but resulted in unacceptably high rates of non-union and hardware failure\(^3,4\).
- A new generation of pre-contoured locked or hybrid compression plates have become popular but clinical superiority has not been proven and is controversial\(^5,6\).
- Despite frequency of procedure ideal technique for joint preparation and arthrodesis fixation has yet to be determined.
2 techniques will be examined for joint preparation
- Flat cut
- Cup and cone reamer
Dorsal plate fixation used for all arthrodeses
- 3rd generation plates
  - Locked or hybrid application
  - Compression through plate
  - Pre-contoured design
  - Additional plantar compression screw frequently used
Hypothesis:
- Both primary techniques will result in improved clinical alignment and satisfactory results with high union rates.
Methods

Retrospective chart review
-  February, 2010 through October, 2014
CPT 28750
-  2 surgeons
-  1 institution
Radiographic review pre and post op
-  Hallux Valgus (HV) angle
-  1-2 Intermetatarsal (IM) angle
-  Hallux Valgus Interphalangeus (HVI) angle
-  Metatarsus Primus Elevatus (MPE)
-  First Ray Length (FRL)
-  1st MTP dorsiflexion angle (Post-op only)
Methods

- Variables Measured
  - Technique
  - Implants
  - Medical comorbidities
  - Previous procedures
  - Additional procedures
  - Tobacco use
  - Complications
  - Time to clinical union
  - Clinical outcomes
    - Union, mal/nonunion, revision
Results

- 116 procedures (114 feet) (108 patients)
  - 27 excluded (22 non-locking construct)
- 89 met inclusion criteria
- 48 flat cut cohort
- 26 cup cone reamer cohort
- 15 revisions procedures
- All patients followed until clinical union or a minimum of 3 months
  - Average 11 months
Results

- **Union Rate**
  - Overall 96%
  - Flat cut cohort 91.7%
  - Cup cone reamer 100%
  - P=0.13

- **Time to clinical healing**
  - Defined as radiographic healing, painless ambulation and transition from post-operative rigid device to an accommodative shoe
  - Flat cut cohort 80.1 (+/- 44.5) days
  - Cup cone reamer 109.6 (+/- 31.1) days
  - P=0.02

- **Complications**
  - Flat cut 17 (35%)
  - Cup cone reamer 3 (12%)
  - P>0.05

- **Hardware Removal**
  - Overall 2 (2.2%)
  - 1 each group

- **Radiographic Analysis**
  - No difference between groups
<table>
<thead>
<tr>
<th></th>
<th>Cup-Cone Reaming</th>
<th>Flat Cut</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>26</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Time to radiographic and clinical healing (mean in days +/- SD)</td>
<td>80.1 (+/-44.5)</td>
<td>109.6 (+/-31.1)</td>
<td>P&lt;0.02</td>
</tr>
<tr>
<td>Non Unions</td>
<td>0 (0%)</td>
<td>4 (8%)</td>
<td>P=0.13</td>
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<td>Complications total</td>
<td>3 (12%)</td>
<td>17 (35%)</td>
<td>p&gt;0.05</td>
</tr>
<tr>
<td>Hardware removal</td>
<td>1 (4%)</td>
<td>1 (2%)</td>
<td>p&gt;0.05</td>
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<tr>
<td>Pre op HV angle (mean)</td>
<td>27.9 (+/-16.2)</td>
<td>29.6 (+/-13.4)</td>
<td>p&gt;0.05</td>
</tr>
<tr>
<td>Post op HV angle (mean)</td>
<td>7.5 (+/-6.0)</td>
<td>10.5 (+/-5.0)</td>
<td>p&gt;0.05</td>
</tr>
<tr>
<td>Change in HV angle (mean)</td>
<td>19.6 (+/-15.7)</td>
<td>19.1 (+/-13.1)</td>
<td>p&gt;0.05</td>
</tr>
<tr>
<td>Pre op IM angle (mean)</td>
<td>12.9 (+/-8.0)</td>
<td>12.2 (+/-5.1)</td>
<td>p&gt;0.05</td>
</tr>
<tr>
<td>Post op IM angle (mean)</td>
<td>9.2 (+/-3.0)</td>
<td>8.8 (+/-3.7)</td>
<td>p&gt;0.05</td>
</tr>
<tr>
<td>Change in IM angle (mean)</td>
<td>3.6 (+/-8.2)</td>
<td>3.4 (+/-5.5)</td>
<td>p&gt;0.05</td>
</tr>
<tr>
<td>Change in 1st ray length (mm)</td>
<td>3.23 (+/-2.18)</td>
<td>3.37 (+/-2.0)</td>
<td>p&gt;0.05</td>
</tr>
</tbody>
</table>
Discussion

- Doty et al reviewed 51 MTP fusions with similar fixation construct
  - Cup and cone reamer preparation
  - Improved alignment
  - 98% fusion rate.
- Hyer et al reviewed 138 MTP fusions with locked and non-locked implants
  - Found no difference in fusion rate between groups
- Mayer et al compared locked and non-locked plates in 128 MTP fusions
  - No difference in fusion rate
  - Longer time to clinical healing in locked plate group
Conclusion

- 1st MTP arthrodesis remains the gold standard for severe deformities.
- Both flat cut and cup cone reamer techniques restore anatomic alignment.
- Dorsal pre-contoured hybrid compression plates with or without compression screws provide adequate rigidity for clinical healing.
- Hardware removal was rarely performed.
- Cup and cone reamer preparation was found to result in clinical healing faster than flat cut preparation.
- Recent literature questions the need for a locked construct in all cases.
- Preparation and fixation techniques can influence outcomes after arthrodesis and options should be considered in operative planning for every case.
References


Thank You